C. M. YODER.

METAL BENDING MECHANISM.

APPLICATION FILED JAN. 4, 1915.

1,203,090.

Patented Oct. 31, 1916.

3 SHEETS—SHEET 1.

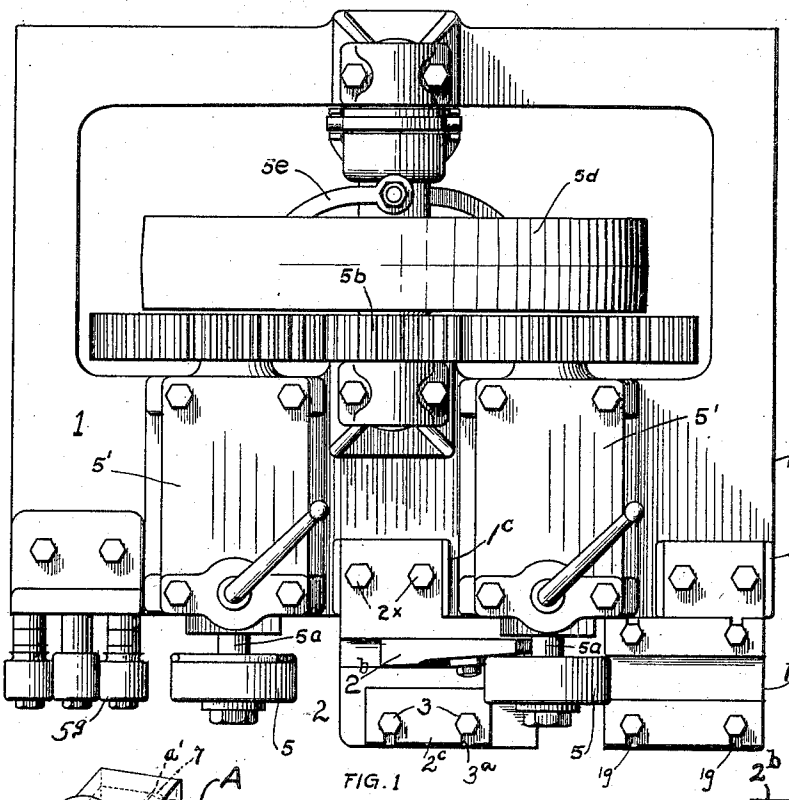


FIG. 1

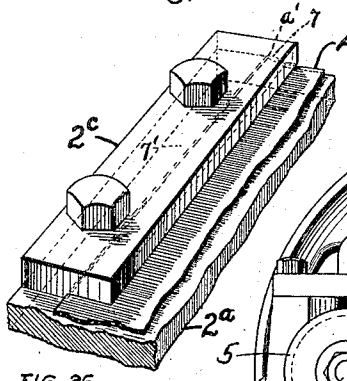


FIG. 26

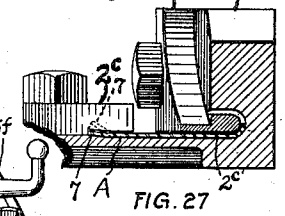


FIG. 27

FIG. 2

Witnesses:
E. W. Allardt.
Jennie Tyers

Inventor:
Carl M. Yoder
By Edward R. Alexander
Attorney

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

C. M. YODER.

METAL BENDING MECHANISM.

APPLICATION FILED JAN. 4. 1915.

1,203,090.

Patented Oct. 31, 1916.

3 SHEETS—SHEET 2.

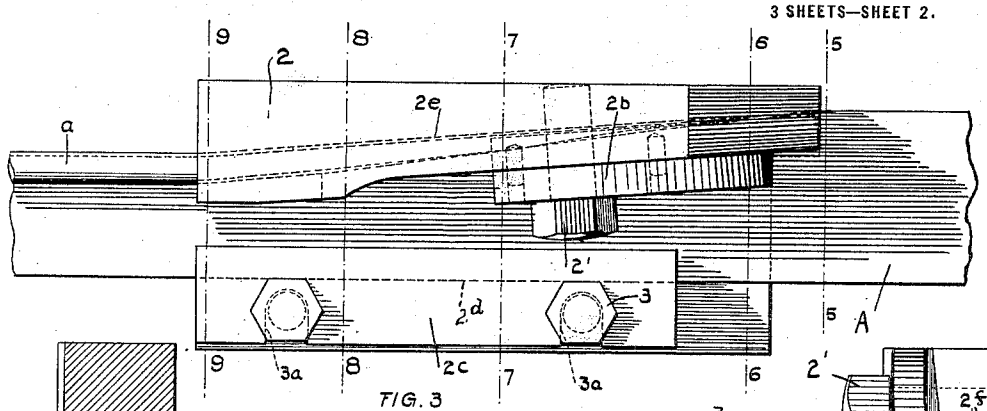


FIG. 3

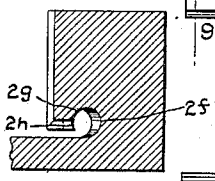


FIG. 9a

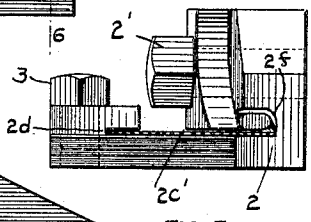


FIG. 5

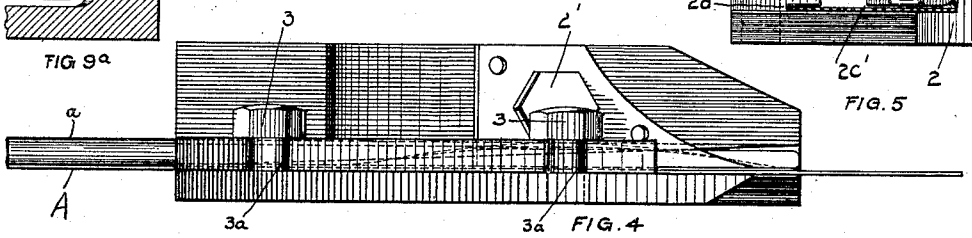


FIG. 4

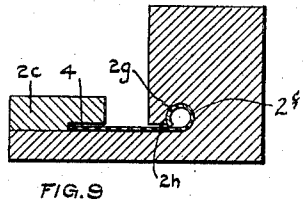


FIG. 9

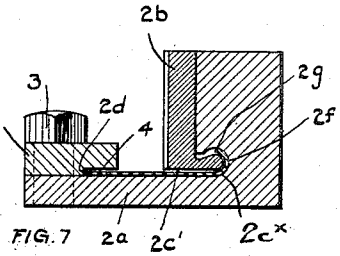


FIG. 7

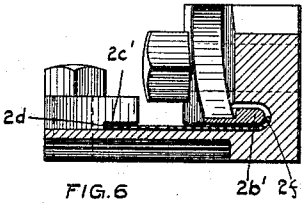


FIG. 6

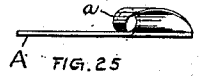


FIG. 25

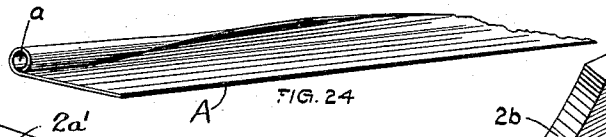


FIG. 24

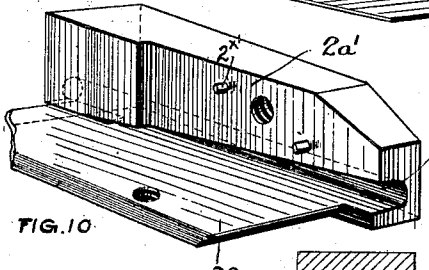


FIG. 10

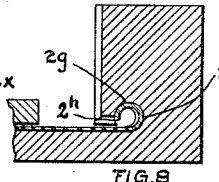


FIG. 8

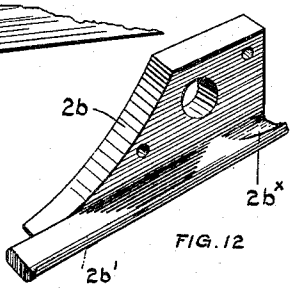


FIG. 12

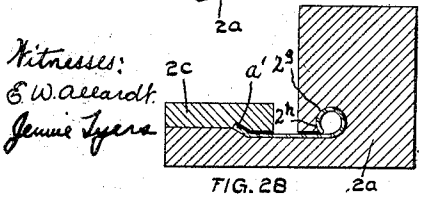


FIG. 28

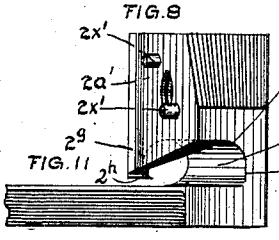


FIG. 11

Witnesses:
E. W. Allardt.
Jennie Tyers

Inventor:
Carl M. Yoder
By Edward P. Alexander
Attorney

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

C. M. YODER.

METAL BENDING MECHANISM.

APPLICATION FILED JAN. 4, 1915.

1,203,090.

Patented Oct. 31, 1916.

3 SHEETS—SHEET 3.

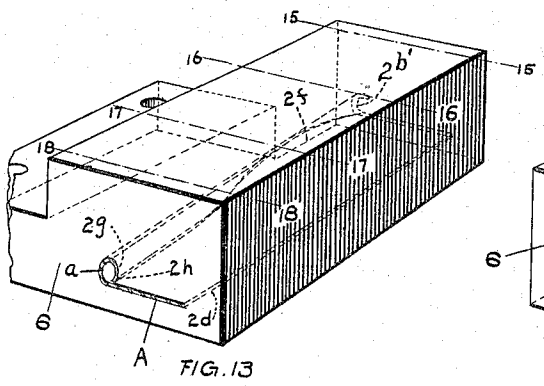


FIG. 13

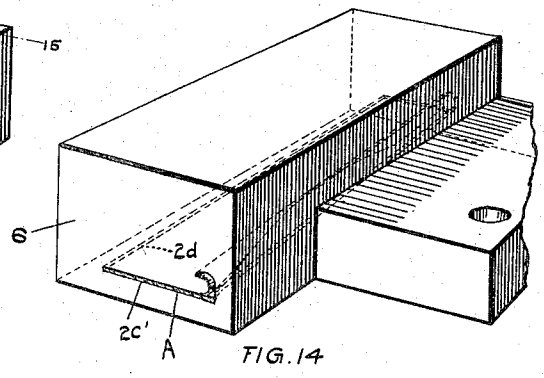


FIG. 14

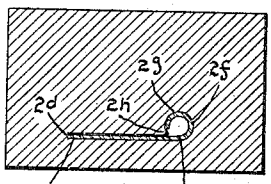


FIG. 17

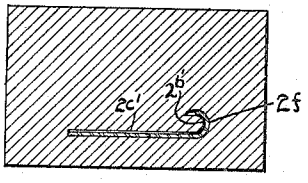


FIG. 16

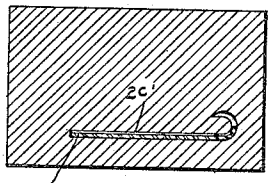


FIG. 15

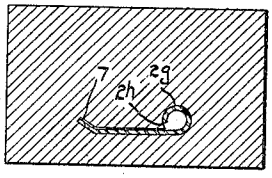


FIG. 22

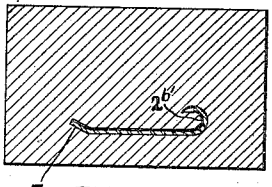


FIG. 21

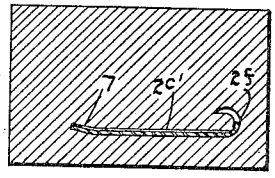


FIG. 20

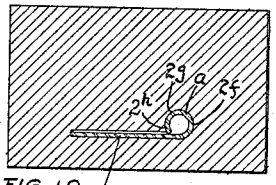


FIG. 18

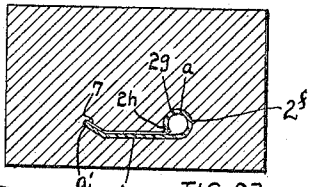


FIG. 23

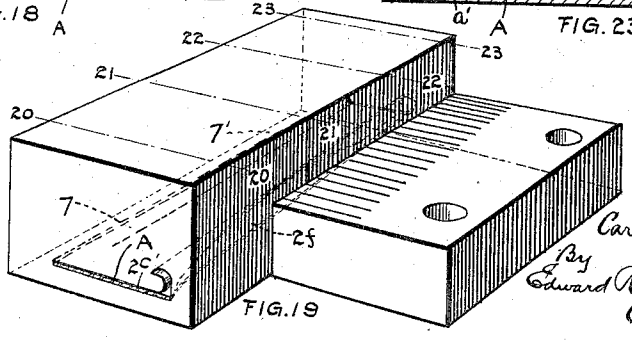


FIG. 19

Witnesses:
E. W. Allardt.
Jennie Syers

Inventor:
Carl M. Yoder
By Edward R. Alexander
Attorney

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

CARL M. YODER, OF CLEVELAND, OHIO.

METAL-BENDING MECHANISM.

1,203,090. Specification of Letters Patent. Patented Oct. 31, 1916.

Application filed January 4, 1915. Serial No. 320.

To all whom it may concern:

Be it known that I, CARL M. YODER, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in and Relating to Metal-Bending Mechanism, of which the following is a specification.

This invention relates to a mechanism for bending sheet metal or other material and particularly to a mechanism of this character adapted to bend or roll laterally either or both longitudinal edges of a sheet metal strip.

One object of the invention is to provide a simple form of mechanism for bending a strip of material along one of its edges into bead shape.

Another object of the invention is to provide a device having co-acting surfaces or walls adapted by a single operation upon a strip of metal to form a bead along an edge thereof.

Another object of the invention is to provide a device adapted to bend or roll a strip of sheet metal along its opposite edges.

For the purpose of illustration I have, in the accompanying drawings, shown and herein described one form of mechanism embodying my invention.

Figure 1 is a top plan view of a machine having a metal bending device embodying my invention. Fig. 2 is a side elevation of the machine, parts being broken away. Fig. 3 is a top plan view of the bending device showing a strip of sheet metal being acted upon thereby. Fig. 4 is a side view of the parts shown in Fig. 3. Fig. 5 is a section on the line 5—5 of Fig 3. Fig. 6 is a section on the line 6—6 of Fig. 3. Fig. 7 is a section on the line 7—7 of Fig. 3. Fig. 8 is a section on the line 8—8 of Fig. 3. Fig. 9 is a section on the line 9—9 of Fig. 3. Fig. 9^a is a fragmentary section on the line 9—9 of Fig. 3, with the strip of metal omitted. Fig. 10 is a perspective view of one part of the bead forming device. Fig. 11 is a front-end view of the part shown in Fig. 10, somewhat enlarged. Fig. 12 is a perspective view of one of the other parts of the bending device. Figs. 13 and 14 are perspective views of a bead forming device, looking at its opposite ends, embodying a modification of the invention. Figs. 15, 16, 17 and 18 are sectional views on the lines 15—15, 16—16, 17—17 and 18—18, respectively, of Fig. 13. Fig. 19 is a perspective view of a bending device having bending walls for bending the metal laterally along the edge opposite to the bead carrying edge. Figs. 20, 21, 22, and 23 are sectional views on the lines 20—20, 21—21, 22—22, and 23—23, respectively, of Fig. 19. Fig. 24 is a perspective view of a strip of metal illustrating the formation of a bead when operated upon by a bending device or member embodying my invention. Fig. 25 is a view looking endwise of the strip of metal from the right hand end of Fig. 24. Figs. 26, 27 and 28 illustrate the metal bending device, of the form of the invention illustrated in Figs. 1 to 12, but constructed to bend up that edge of the metal opposite to the bead carrying edge, Fig. 26 being a fragmentary perspective view and Figs. 27 and 28 transverse sectional views corresponding to Figs. 5 and 9, respectively.

In the drawings, 1 indicates a suitable frame or bed supported by a set or plurality of legs 1^b. The bed 1^a is preferably provided with a pair of standards 1^c on one of which is supported a guide plate 1^d.

2 indicates as an entirety a device which operates upon a strip of sheet metal or other material, indicated at A, to form or bend the metal along one longitudinal edge of the strip into a bead as the strip of metal moves relative to said device. The bending device herein illustrated and described is adapted to form a bead of curvilinear shape in cross section. The device 2 preferably comprises a plurality of rigidly connected together parts 2^a, 2^b and 2^c, which are constructed and correlated to form in and through the device a longitudinally extending groove, opening or passageway $2^{c'}$ and a curved side wall 2^{cx} which is connected to or emerges into the bottom wall of the passageway $2^{c'}$. As will be later described, portions or sections of the side walls in coöper-

ation with the walls of the opening $2^{c'}$ of the device 2 serve to bend, curve, or roll the metal along or adjacent to one edge of a strip into bead shape as the strip slides endwise through the passageway.

The front end of the groove $2^{c'}$ is substantially rectangular in cross-section to receive the metal strip A as it is fed to the device 2 in its flat shape. The bottom wall of the passageway $2^{c'}$ is preferably flat to correspond to the shape of the metal strip A.

The passageway $2^{c'}$ is provided along one longitudinal edge with a side wall 2^{d} which is preferably straight from end to end (see Figs. 3 to 9, inclusive), and guides the strip A through the passageway in the manner hereinafter described. The side wall 2^{cx} is curved upwardly or laterally relative to the main or central portion of the bottom wall of the passageway and then inwardly, as shown at 2^{f}. The wall 2^{f} operates to bend or roll the metal of the strip into substantially semi-circular shape. The curved side wall 2^{cx} increases in width from the front to the rear end of the device 2 to provide sections 2^{g}, 2^{h}, which operate to guide the rolled portion of the metal strip downwardly and outwardly, and complete the formation of the circular hollow bead *a* with the free longitudinal edge of the metal strip A substantially in engagement with the upper or adjacent surface thereof.

The walls or sections 2^{f}, 2^{g} and 2^{h}, are curved on the same radius about an axis which is inclined from front to rear of the device 2 toward the longitudinal axis of the strip A, as shown at 2^{e}. By the construction and arrangement just described the walls or sections 2^{f}, 2^{g} and 2^{h} lie in the path of movement of that portion of the metal which is rolled into bead shape and thus effect the bending or rolling thereof as the strip A moves endwise through the passageway $2^{c'}$.

The walls or sections 2^{f}, 2^{g}, 2^{h} are connected together or merge into one another and with the bottom wall of the passageway $2^{c'}$ so that the bead is formed by substantially one continuous operation, as will be later described.

The part 2^{b} is provided with a rib $2^{b'}$ which forms the upper surface or opposing wall of the passageway $2^{c'}$ and along its outer side the rib $2^{b'}$ is curved to provide a former about which the metal is rolled or bent as the metal strip A engages with the upwardly and inwardly curved wall 2^{f}. The rib $2^{b'}$ terminates at a suitable distance forward of the curved walls 2^{g}, 2^{h}, to permit the completion of the bead *a* thereby. At 2^{bx} the rib $2^{b'}$ is cut away to prevent contact of the metal strip therewith as its free edge is rolled or bent over into its final form.

The metal bending part 2^{a} is preferably secured by bolts 2^{x} to the other standard 1^{c} in line with the guide 1^{d}. The part 2^{a} is provided with a vertical wall $2^{a'}$ to which the part 2^{b} is rigidly clamped by a bolt 2'. The wall $2^{a'}$ is preferably inclined from its front end to its rear end and extends in a plane substantially parallel to the axis of the sections 2^{f}, 2^{g}, 2^{h}, of the side wall 2^{cx}, so that when the part 2^{b} is clamped to the wall $2^{a'}$, its rib $2^{b'}$ will be supported substantially concentrically to the wall 2^{cx}.

$2^{x'}$ indicates dowel pins which facilitate the positioning of the part 2^{b} on the part 2^{a}. The part 2^{c} may be detachably secured to the part 2^{a} by one or more bolts 3. On its under side the part 2^{c} is cut away as shown at 4 to form the side wall 2^{d} and upper wall of the passageway $2^{c'}$. The part 2^{c} is preferably formed with elongated slots 3^{a}, to receive the bolts 3. The slots 3^{a} permit the part 2^{c} to be adjusted laterally to accommodate itself to metal strips of varying widths.

The metal strip is preferably fed to and through the bending device 2 by one or more sets of superposed feeding rolls 5. When two sets of rolls are employed they may be arranged forward and rearward of the device 2. Each roll 5 is fixed to one end of a shaft 5^{a}. The shafts 5^{a} are mounted in journal boxes 5'. At its opposite end each shaft 5^{a} carries a gear which is driven directly or indirectly by a main gear 5^{b}, mounted on a main driving shaft 5^{c}.

5^{d} indicates a pulley which, through a suitable clutch 5^{e}, serves to drive the shaft 5^{c}.

The uppermost rolls of the sets of feeding rolls 5 may be mounted in adjustable bearings and adjusted by devices 5^{f} to cause proper frictional engagement of the feeding rolls 5 with the metal strip A.

5^{g} indicates a set of straightening rolls which are preferably provided at a point beyond the rearmost feeding rolls 5. The guide 1^{d} for the metal strip is preferably arranged in front of the forward feeding rolls 5. The guide 1^{d} may be provided with detachable plates 1^{e}, adjustably secured in position by bolts 1^{f}. The plates 1^{e} are formed with slots 1^{g} which permit them to be moved toward and from each other to accommodate metal strips of different widths.

From the foregoing description it will be understood that portions or sections of the walls 2^{cx} are curved upwardly or laterally and inwardly and then downwardly and outwardly, and that said curved walls have an inclination from the front to the rear end of the bending device 2 toward the longitudinal axis of the strip A, as shown at 2^{e}.

In operation, a strip of metal A preferably of the same width as the passageway $2^{c'}$ is used and fed endwise to and through

the bending device 2. After it enters the passageway, one edge of the strip engages with the inclined and upwardly and inwardly curved wall 2^f, and the downwardly and outwardly curved walls 2^g, 2^h, which co-act by a single continuous operation to bend or roll the bead *a*. The side wall 2^d of the passageway $2^{e'}$ serves as an abutment for the strip A to prevent lateral movement thereof during its endwise movement through the device 2, and in this manner cooperates with the upper and lower walls of the passageway $2^{e'}$ to guide the strip therethrough and cause the coöperating inclined and curved walls or sections 2^f, 2^g, 2^h, and rib $2^{b'}$ to roll, bend or shape the metal into a bead.

In Figs. 13, 14, 15, 16, 17 and 18, I have illustrated a slightly different form of metal bending device. In this form of the invention, the passageway $2^{e'}$ for the strip of metal A is formed in a solid piece or block of material 6. The passageway $2^{e'}$ through the block 6 is provided with a plurality of curved walls or sections 2^f, 2^g, 2^h, $2^{b'}$, which are similar in shape and co-act in the same manner as do the coöperating walls or sections 2^f, 2^g, 2^h, $2^{b'}$, in the form of the invention illustrated in Figs. 1 to 12, inclusive, except that the central portion of the upper wall of the passageway $2^{e'}$ is continuous from edge to edge.

When it is desired to bend or roll the sheet metal strip A laterally along both of its longitudinal edges, portions of the upper and lower walls of the passageway $2^{e'}$, adjacent to the end wall 2^d are curved, relative to the walls forming the central or main portion of the passageway $2^{e'}$, and the adjacent end wall 2^d is inclined from end to end of the device 2, relative to the longitudinal axis of the strip A. In the example herein shown, (see Figs. 19, 20, 21, 22, 23, 26, 27 and 28,) the opposing walls of the passageway may be curved laterally as shown at 7 to curve or bend the metal relative to the body portion of the strip and the side wall 2^d inclined, as shown at 7', to form a laterally projecting member *a'* along the edge of the strip A. As the strip of metal moves through the passageway $2^{e'}$ of the bending device 2 (Figs. 26, 27, 28) or block 6 (Figs. 19 to 23, inclusive), it engages with and is bent laterally by the inclined and curved walls 7', 7, to the desired shape. The curved and inclined walls 7, 7', preferably commence at a point near the front end of the passageway $2^{e'}$ so that the bending of the metal may be effected in a gradual manner, as will be understood from Figs. 19 and 26.

It will be noted that I have provided a simple form of bending device adapted by a single operation to bend, curve or roll sidewise or laterally the metal of a strip along either longitudinal edge thereof; in other words, as the metal strip A is fed endwise to and through the bending device 2, the metal along either or both edges of the strip is rolled or bent into the desired shape by one continuous operation. In all machines and apparatus of which I am aware it was necessary to subject the metal to at least two separate and distinct operations to form a complete bead. By my invention I am enabled to reduce the number of required steps to one operation.

The construction herein described is advantageous in that it operates to form a bead of uniform size and shape from end to end of the strip; furthermore, as no moving parts, which operate upon the metal to bend it wholly or in part into bead shape are used, the frame work and other parts of the apparatus can be of relatively light construction without sacrificing strength or durability of the apparatus.

The strip A may be of indefinite length and fed in a continuous manner to and through the device 2; or if desired, strips A previously cut into sections or lengths may be used.

To those skilled in the art of making mechanism of the class described, many alterations in construction and widely differing embodiments and applications of my invention will suggest themselves, without departing from the spirit and scope thereof.

My disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

I preferably provide the curved wall 2^{ex} with a plurality of curved sections when it is desired to form a bead of circular form; however, under some circumstances the curved section 2^h may be omitted. Again, when it is found unnecessary to bend downwardly the rolled over edge of the metal, the curved section 2^g may also be omitted.

What I claim is:

1. A metal bending device having a passageway adapted to receive a flat strip of sheet metal and a side wall extending substantially from end to end of the device, said side wall being curved upwardly relative to one edge of the passageway about an axis inclined to the longitudinal axis of the metal strip, the bottom wall of the passageway and said side wall merging together and said curved side wall increasing in extent or width on the same radius from the front end to the rear end of the passageway, whereby said curved side wall operates to bend or roll one edge of the metal strip into a bead.

2. A metal bending device having a passageway adapted to receive a flat strip of sheet metal and a side wall extending sub-

stantially from end to end of the device and curved upwardly relative to one edge of the passageway about an axis inclined to the longitudinal axis of the metal strip, the bottom wall of the passageway and said side wall merging together and said curved side wall increasing in extent or width on the same radius from the front end to the rear end of the passageway, whereby said curved side wall operates to bend or roll one edge of the metal strip into a bead.

3. A metal bending device formed with a passageway adapted to receive a flat strip of sheet metal, a side wall for said passageway serving as an abutment with which one longitudinal side edge of a strip of metal engages, and a side wall at the opposite side of said passageway and connected to the adjacent longitudinal edge of the bottom wall thereof, the last mentioned side wall being curved upwardly relative to the bottom wall of the passageway about an axis inclined to the longitudinal axis of said passageway and increasing in extent or width on the same radius about said axis from the front end to the rear end of the passageway.

4. A metal bending device formed with a passageway adapted to receive a flat strip of sheet metal, said passageway having along one side inner and outer coöperating walls curved about an axis which is inclined relative to the longitudinal axis of said device, said walls being constructed and arranged to give the edge of the metal a predetermined curvature as it moves through the device, the inner wall terminating at a point remote from the rear end of the outer curved wall and permitting the said outer wall to roll the edge of the metal into a bead.

5. A metal bending device formed with a passageway adapted to receive a flat strip of sheet metal, said passageway having an outer wall curved about an axis which is inclined relative to the longitudinal axis of said device, all portions of said curved wall having the same radii, and a curved inner wall arranged concentric to the outer wall and extending from the front end of the outer wall to a point remote from its rear end, said inner and outer walls coöperating to give the edge of the metal a predetermined curvature as it moves between them, whereby the outer wall will roll the metal edge into a bead as the strip moves through said device.

6. A metal bending device having a passageway adapted to receive a flat strip of sheet metal and a side wall extending substantially from end to end of the device and curved upwardly relative to one edge of the passageway about an axis inclined to the longitudinal axis of the metal strip, the bottom wall of the passageway and said side wall merging together and said curved side wall increasing in extent or width on the same radius from the front end to the rear end of the passageway, whereby said curved side wall operates to bend or roll one edge of the metal strip into a bead, and an adjustable side wall with which the opposite edge of the metal strip engages.

7. A metal bending device having a passageway adapted to receive a flat strip of sheet metal and a side wall extending substantially from end to end of the device and curved upwardly relative to one edge of the passageway about an axis inclined to the longitudinal axis of the metal strip, the bottom wall of the passageway and said side wall merging together and said curved side wall increasing in extent or width on the same radius from the front end to the rear end of the passageway, whereby said curved side wall operates to bend or roll one edge of the metal strip into a bead, the upper and lower walls of the passageway along that edge opposite to said side wall being curved laterally from the front end to the rear end of the device to roll up the other edge of the strip.

8. A metal bending device having a passageway adapted to receive a flat strip of sheet metal and a side wall extending substantially from end to end of the device and curved upwardly relative to one edge of the passageway about an axis inclined to the longitudinal axis of the metal strip, the bottom wall of the passageway and said side wall merging together and said curved side wall increasing in extent or width on the same radius from the front end to the rear end of the passageway, whereby said curved side wall operates to bend or roll one edge of the metal strip into a bead, in combination with means for moving the metal strip through the passageway.

9. In a metal bending apparatus, the combination of a device comprising a base member having a flat surface forming the bottom wall of a passageway through which a strip of metal moves and a laterally extending member having a curved wall extending substantially from end to end of said member and connected to the bottom wall along one edge thereof to form one side wall of the passageway, all portions of said curved side wall being curved on the same radius about an axis extending at an inclination to the direction of movement of the strip of metal through the passageway, said base member being provided with a wall at the opposite side of the passageway forming the other side wall thereof, and a separate member fixed to said laterally extending member and spaced from the surface of the base member to form the upper wall of the passageway.

10. A metal bending device having a passageway adapted to receive a flat strip of

sheet metal, one side wall of the passageway extending substantially from end to end of the device and connected to and curved upwardly relative to one longitudinal edge of the bottom wall of said passageway, all portions of said side wall being curved on the same radius about an axis inclined to the direction of movement of the strip of metal, whereby said side wall operates to bend or roll one edge of the metal strip.

In testimony whereof I affix my signature, in the presence of two witnesses.

CARL M. YODER.

Witnesses:
GEO. B. PITTS,
EDNA F. WRENTMORE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."